Research Summary

Evaluating the Safety Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts

Research Need

The purpose of this research project was to evaluate the safety impacts of the FYA left-turn indication through an in-depth before/after implementation crash analysis and benefit-to-cost ratio.

Goals/Objectives

This project addressed four main objectives:

1. To develop an FYA inventory database to track and itemize the installations to-date as of February 2020. Based on this inventory, study locations were filtered based on available years of post-installation crash data. More so, volume data was obtained from MS2 and Roadway Inventory databases for each of the study intersections.

2. To conduct an in-depth crash analysis of pre- and post-implementation periods for the FYA signal indication at all of the acceptable study intersections with a permissive left-turn FYA indication installed across Massachusetts

3. To perform a cost/benefit analysis for the implementation of the FYA at statewide protected/permissive left-turn indications. The FYA implementation costs were derived from MassDOT contract information and strategic interviews with local consultants.

4. To provide a prioritization plan moving forward in future MassDOT retrofitting procedures, taking into consideration the results of both the safety assessment and cost/benefit analysis. The guidance provided in this plan will promote effective and safe implementation of the FYA left-turn signals in future projects.

Methodology

In this project, the research team compiled a complete inventory of statewide FYA intersections, including various metrics such as jurisdiction, treatment type, and intersection infrastructure elements. Using a spatial buffer of 200-ft around each intersection, crash data was collected for a period of 2-years before and 2-years after the implementation of each FYA intersection.

Upon collecting accurate and reliable volume data, a total of 166 FYA intersections were evaluated in three treatment categories: 3-way intersections with one FYA approach (Treatment #1), 4-way intersections with one FYA approach (Treatment #2), and 4-way intersections with two-or-more FYA approaches (Treatment #3). Vehicle crashes were aggregated from the intersection-level and characterized into the following: total crashes, injury crashes, property damage only (PDO) crashes, rear-end crashes, angle crashes, single vehicle crashes, head-on crashes, left-turn (LT) crashes, and left-turn-opposing-through (LTOT) crashes. Crash data was analyzed using average annual before/after by crash type, taking into consideration the KABCO injury scale to determine injury severity impacts. More so, Equivalent Property Damage Only (EPDO) crashes were taken into consideration. Benefit-to-cost ratios were calculated using annualized FYA costs versus the economic crash reductio benefits.

Key Findings

The research team evaluate FYA intersections in Massachusetts with regards to cost efficiency and safety benefits:

- LTOT-related crash rates were only significantly reduced in treatment category #3
- Treatment Categories #2 and #3 significantly reduced EPDO crashes; however, #1 resulted in a slight increase in EPDO crashes
- In MassDOT adjusted economic cots, Treatment Category #1 yielded the highest BC ratio range (180:1 to 22:1) and Treatment Category #3 yielded the lowest (22:1 to 3:1)
- Economic benefits suggest that the FYA signal retrofits should be widely implemented, regardless of intersection type

Overall, The results provided overwhelming evidence that the FYA reduced the average annual number of injury-related crashes, and ultimately led to a lower economic cost of injuries at all three of the treatment types investigated in this study.

Use of Findings

This study developed the foundation for future safety analysis studies on traffic signal infrastructure, given the holistic assessment of before/after FYA crashes. The FYA inventory established through this project will provide MassDOT with a working database to continue monitoring and assessing the installation of FYA signals across Massachusetts. With refined traffic volume data collection, further studies could evaluate a larger sample of FYAs using the methodologies established here. Given the findings of this study, which revealed a significant benefit to cost ratio for all of the treatment intersections, efforts should be made to highlight the benefits of the flashing yellow arrow at protected-permissive left-turn locations statewide, particularly when implementing locally owned-operated FYA signals.

Project Information

massDOT
Massachusetts Department of Transportation